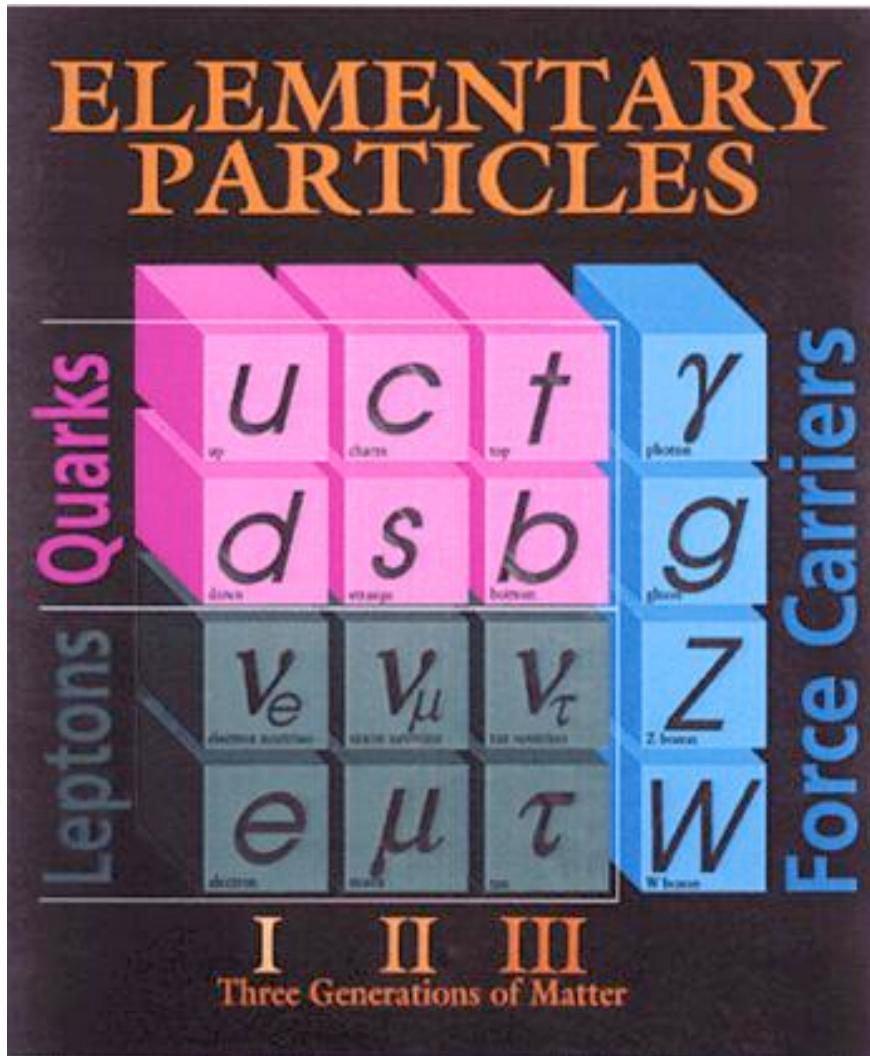


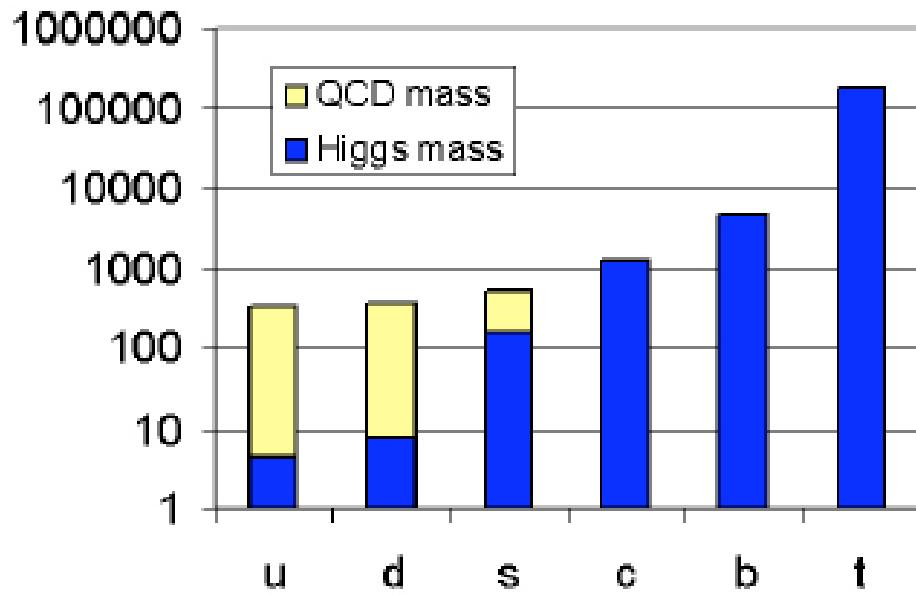
The Standard Model



- Masses are free parameters !
- Origin of Mass ?



Origin of Mass

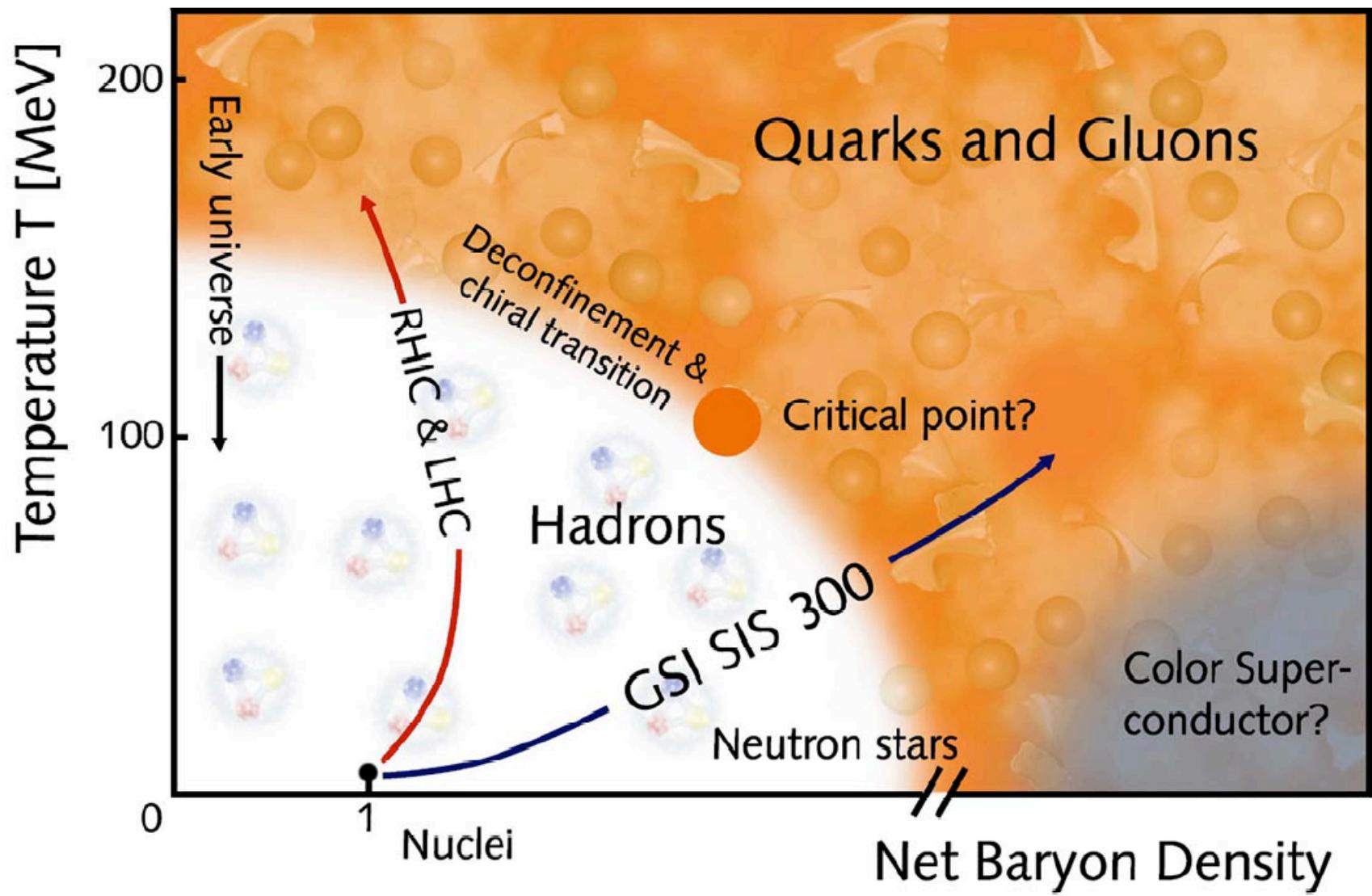


- ❑ Standard Model knows two mechanisms to create mass:
 - Higgs field
 - chiral symmetry breaking

- ❑ Study effects of chiral symmetry restoration

- ❑ What is the origin of mass ?

*Plot: B. Mueller, Duke University.





D - Meson Mass Splitting*

D-Meson mass splitting

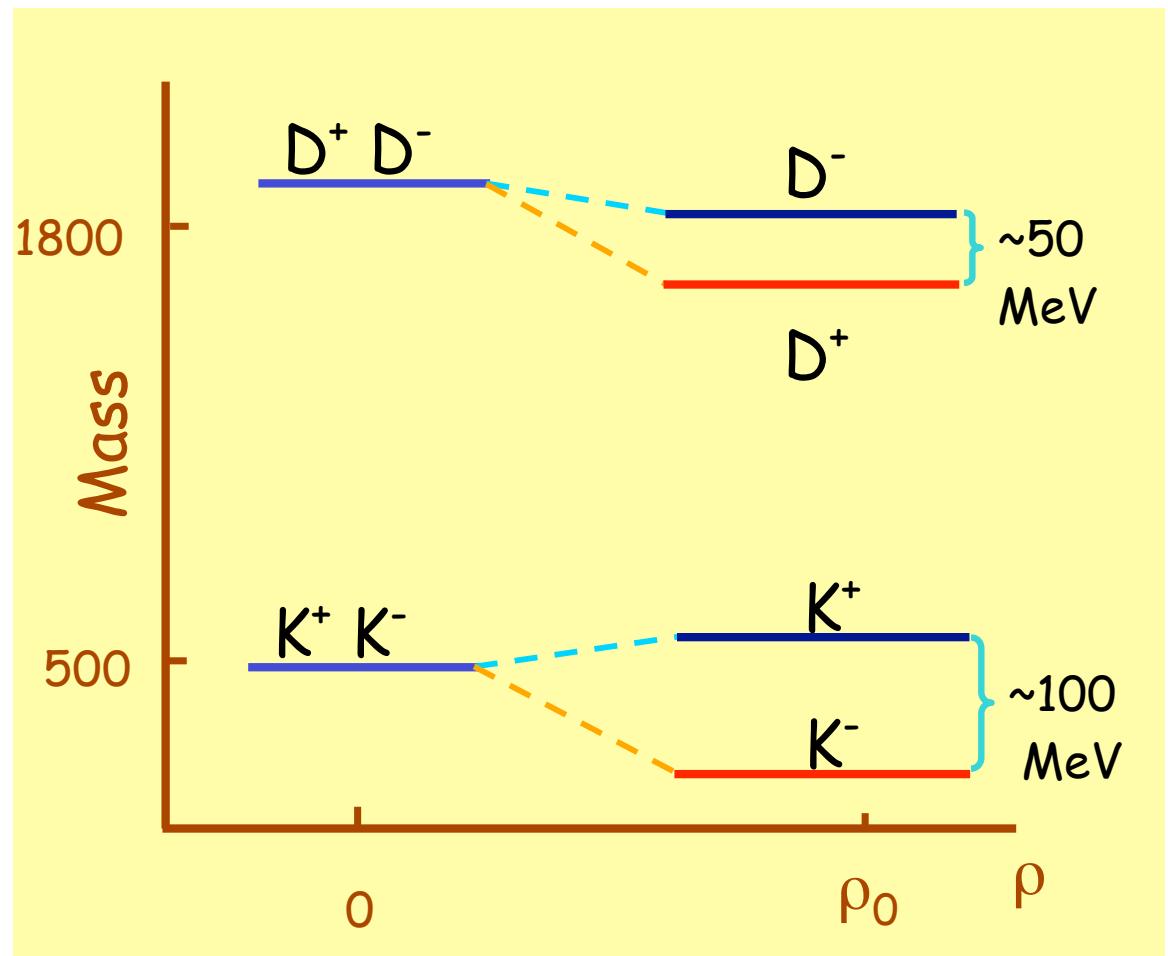
at $n_B \neq 0$

$$|D^-\rangle = |d\bar{c}\rangle$$

$$|D^+\rangle = |c\bar{d}\rangle$$

Explore D-meson properties in dense matter at energies around charm threshold

$E \approx 30 \text{ A GeV}$

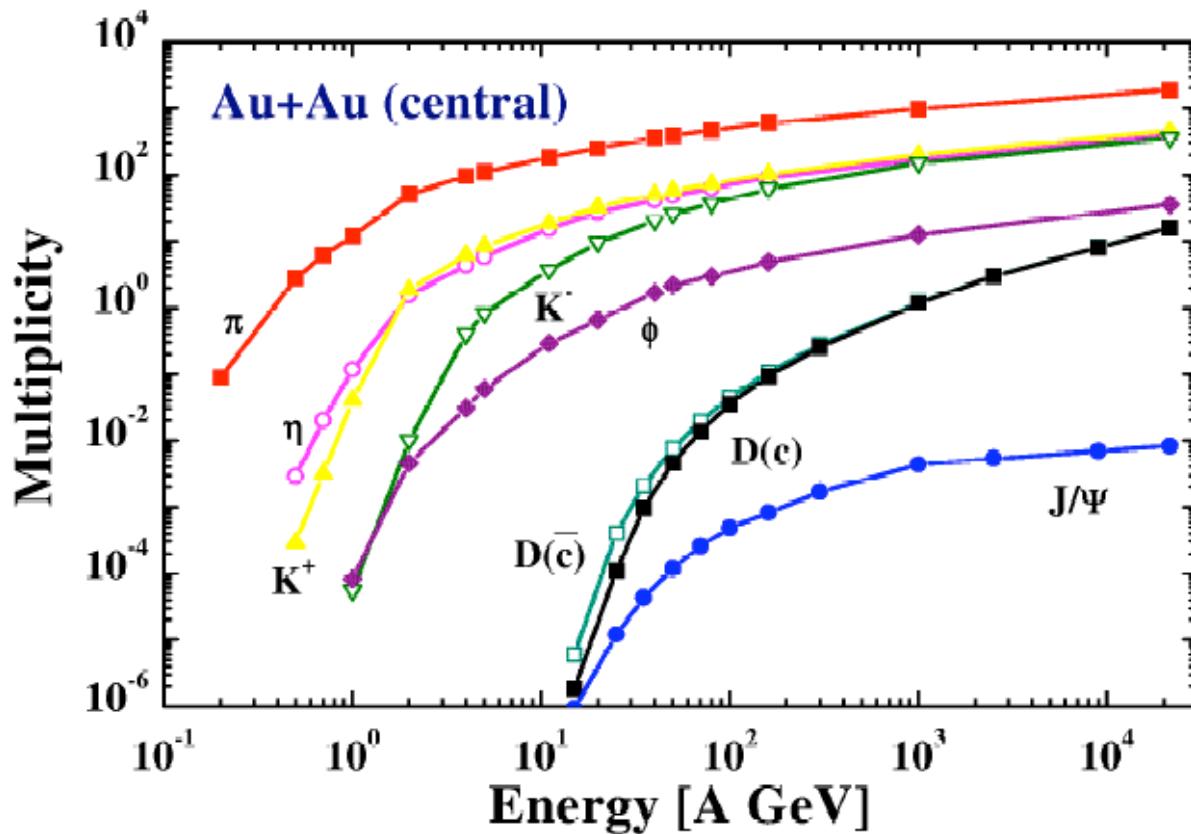


*W. Weise, Intern. Workshop on Gross Properties of Nuclei and Nuclear Excitations, Hirschegg, Austria (2001).

A. Hayashigaki, Phys. Lett. B 487, 96 (2000).



Production Rates

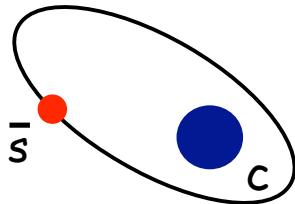


- Measure D – mesons at threshold
- Mass Shift translates into different production rates for D^+ and D^-
- $D^0 \rightarrow K + \pi$, $c\tau \sim 100 \mu\text{m}$

Chiral Multiplets

D-mesons:

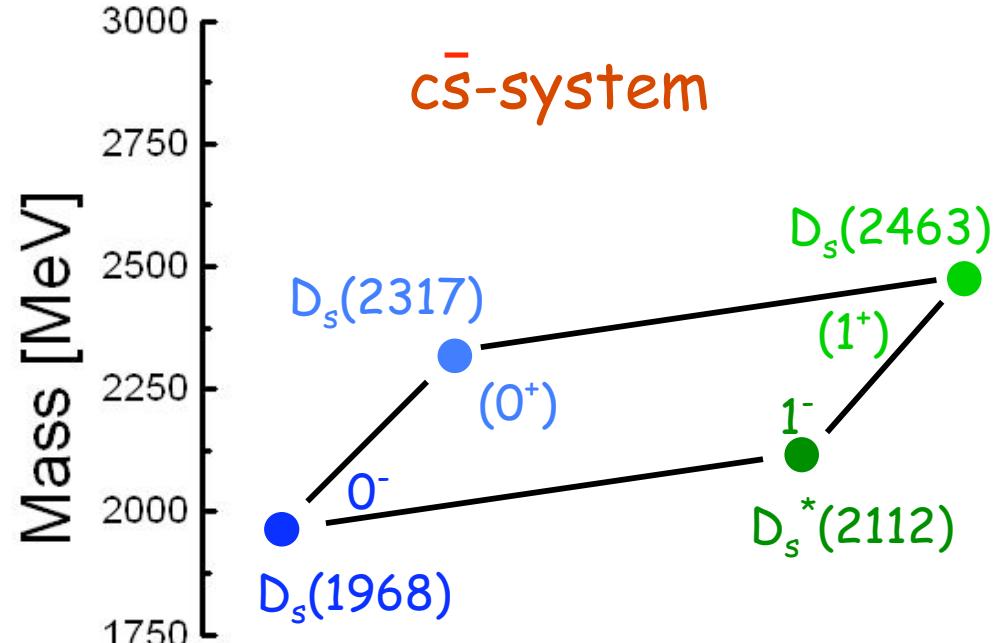
- Heavy-light system
- Hydrogen atom of QCD



- Light-quark-cloud probes chiral symmetry

W.A. Bardeen, E. Eichten, C.T. Hill, PRD 68, 054024 (2003).

B. Friman, JPG: Nucl. Part. Phys. 30 S895 (2004).



Chiral mass shifts ≈ 350 MeV

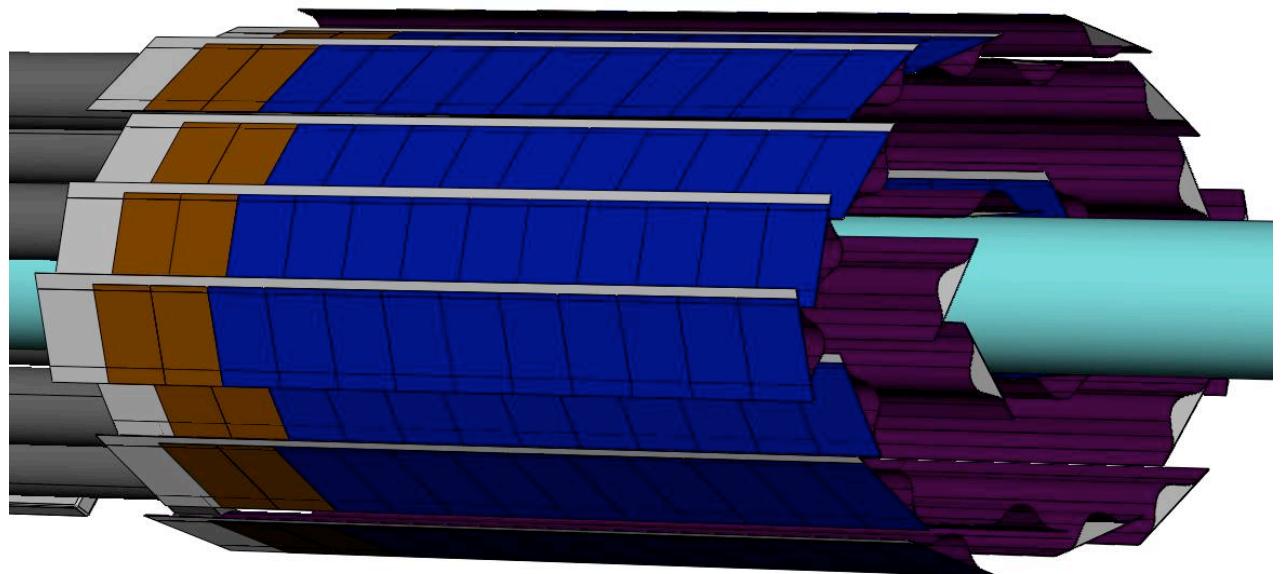
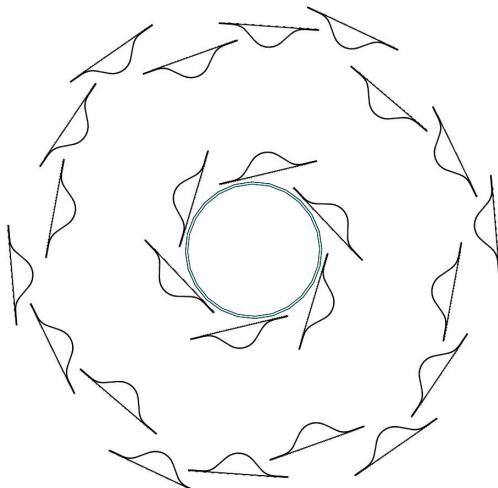
$$D_s(0^+) \not\rightarrow D(0^-) + K$$

$$D_s(0^+) \rightarrow D_s(0^-) + \pi$$



The Heavy Flavor Tracker

People: F. Bieser, R. Gareus, L. Greiner, H. Matis, M. Oldenburg,
L. Pierpoint, F. Retiere, H.G. Ritter, K.S., A. Shabetai(IReS),
E. Sichtermann, H. Wieman, N. Xu, E. Yamamoto



- ❑ Measure open charm display decay vertex:
 $D^0 \rightarrow K + \pi$, $c\tau \sim 100 \mu\text{m}$



Summary

- Study effects of chiral symmetry restoration at large baryon density

- Search for chiral critical point

